

A large, detailed image of the Earth as seen from space, showing the Americas and surrounding oceans and clouds. It is centered behind the main title text.

NASA Earth Science Enterprise Public Health Applications Program

John C. Stennis Space Center
February 26, 2003



Agenda

- Introduction and background
- What is Public Health?
- Why is NASA involved?
- Heritage efforts in Public Health research
- Program realignment and new directions
- Q & A



Public Health Mission

“Fulfill society’s interest in assuring conditions in which people can be healthy through organized, interdisciplinary efforts that address the physical, mental and environmental health concerns of communities and populations at risk for disease and injury” - Institute of Medicine

3 Core Public Health Functions:

- Assess and monitor the health of communities and populations to identify health problems and priorities**
- Formulate public policies designed to solve identified local and national health problems and priorities**
- Assure that all populations have access to appropriate and cost-effective care, including health promotion and disease prevention services**

Operating word: Community/population health (v. provision of direct medical services). The focus is on populations v. individuals

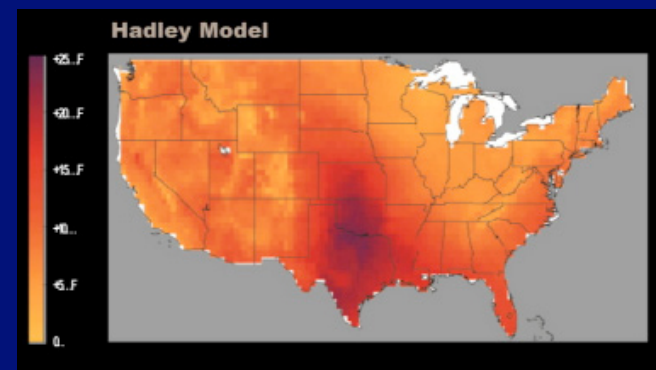
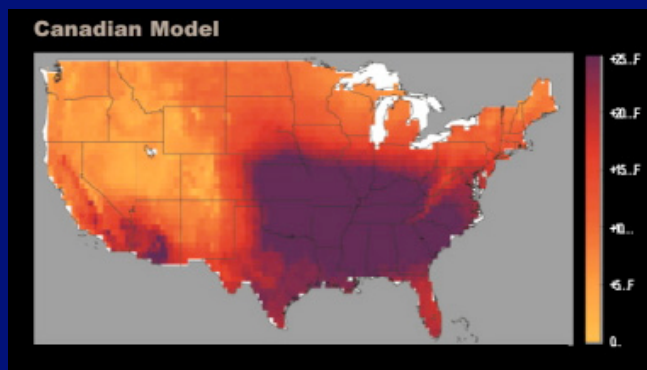


Why NASA – Why Public Health?

Humanity's influence on the global climate will grow in the 21st century. Increasingly, there will be significant climate-related changes that will affect each one of us [US Global Change Research Program]

- U.S. Global Change Research Program (USGCRP) Act of 1990 Public Law 101-606. NASA is a USGCRP Participating Agency
- The National Assessment climate models indicate the North American climate will be characterized by increased temperatures, an altered hydrologic cycle, and increased variability

July Heat Index Change – 21st Century

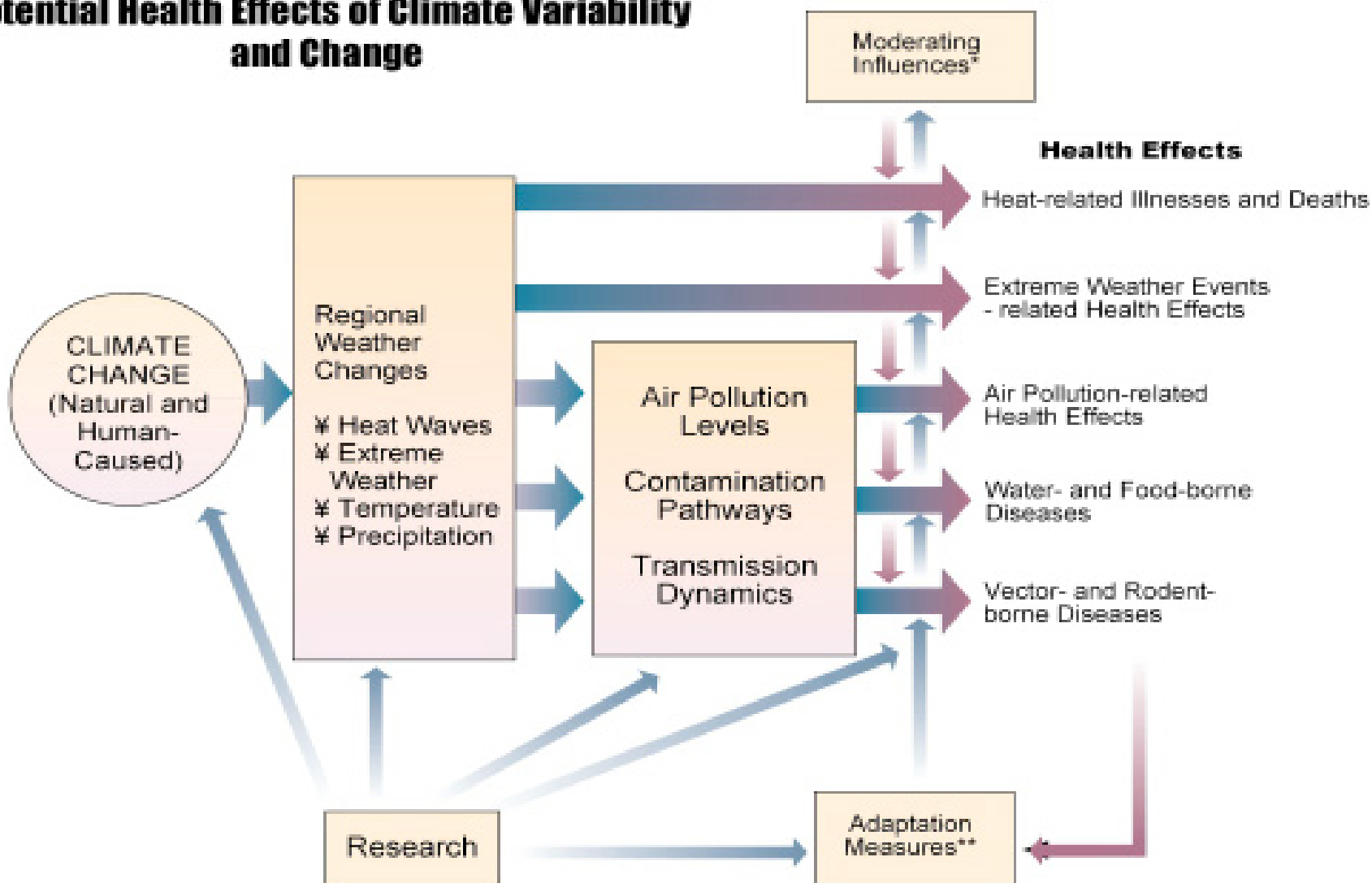


Map by B. Felzer, UCAR, based on data from Canadian and Hadley modeling centers
<http://www.usgcrp.gov/usgcrp/Library/nationalassessment/healthimages.htm>



Why NASA – Why Public Health?

Potential Health Effects of Climate Variability and Change



Patz et al., 2000

<http://www.usgcrp.gov/usgcrp/Library/nationalassessment/healthimages.htm>



Earth Science Enterprise: Applications

Applications Goal

Expand and accelerate the realization of economic and societal benefits from Earth science, information and technology

12 National Applications



Carbon Management



Public Health



Energy Forecasting



Aviation Safety



Water Management



Homeland Security



Coastal Management



Disaster Preparedness



Agricultural Competitiveness



Invasive Species



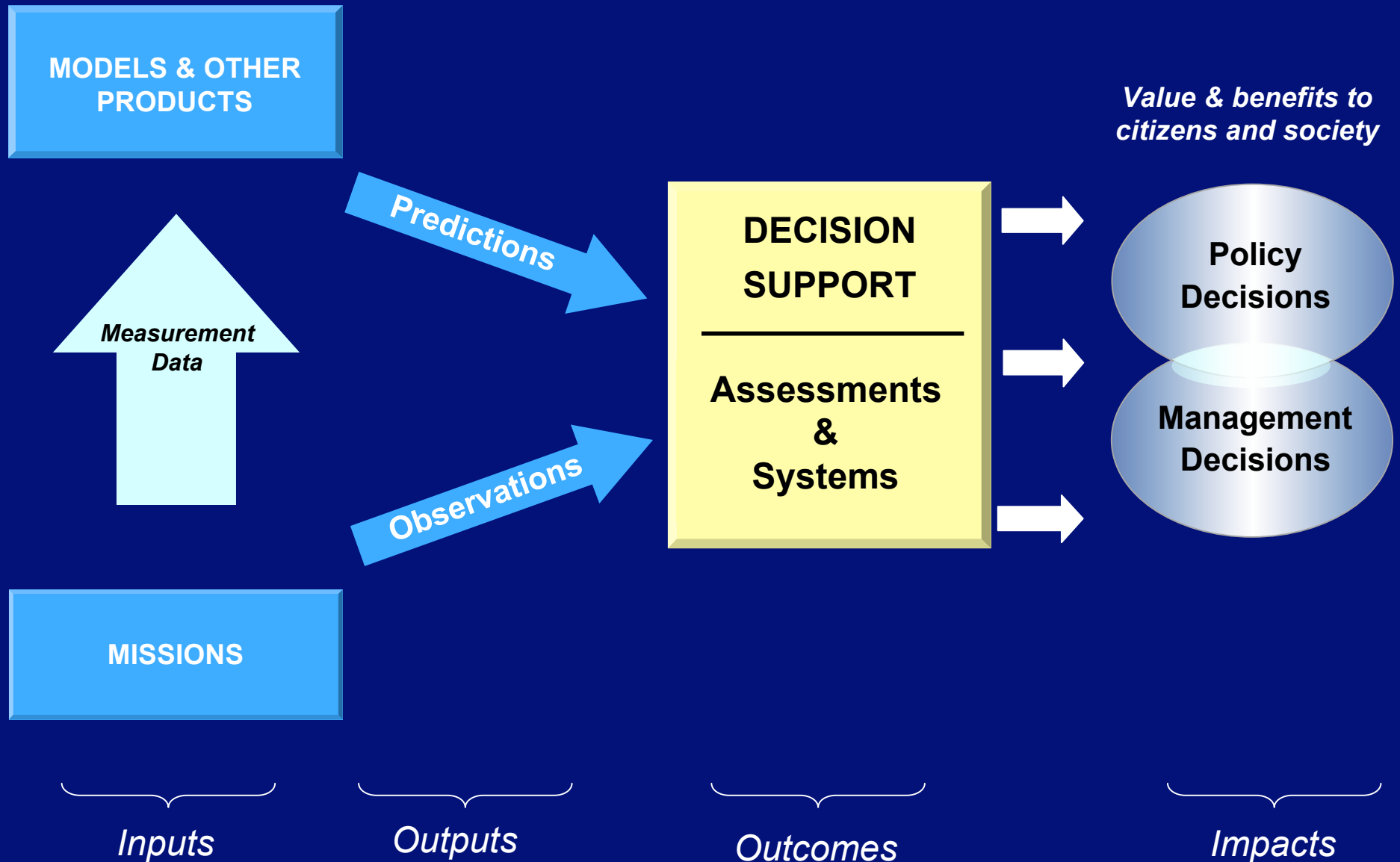
Community Growth



Air Quality

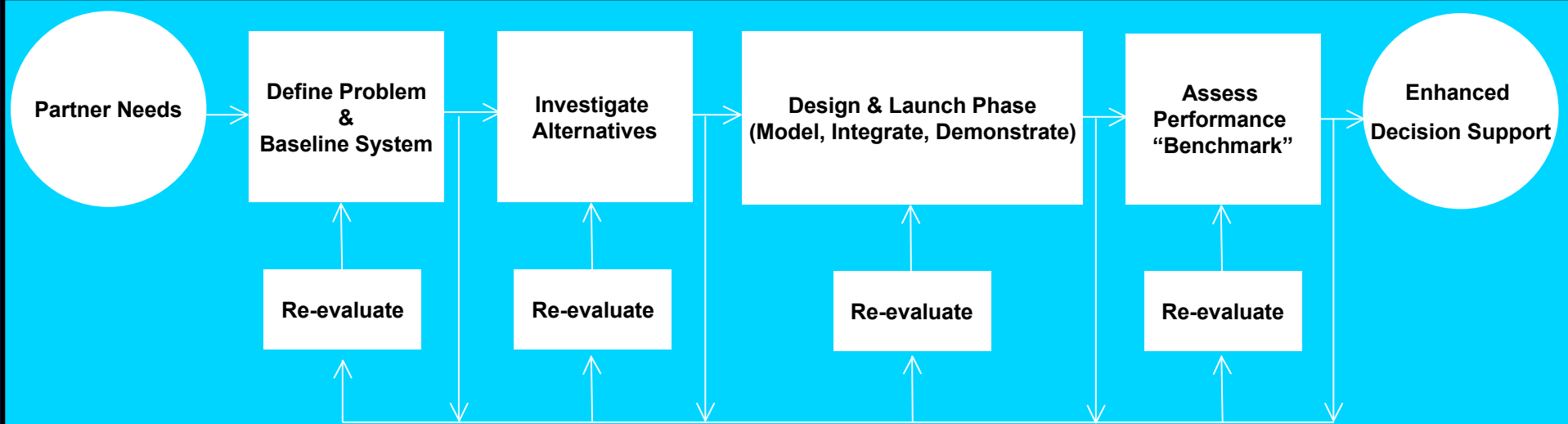


Application Framework





Applications Approach



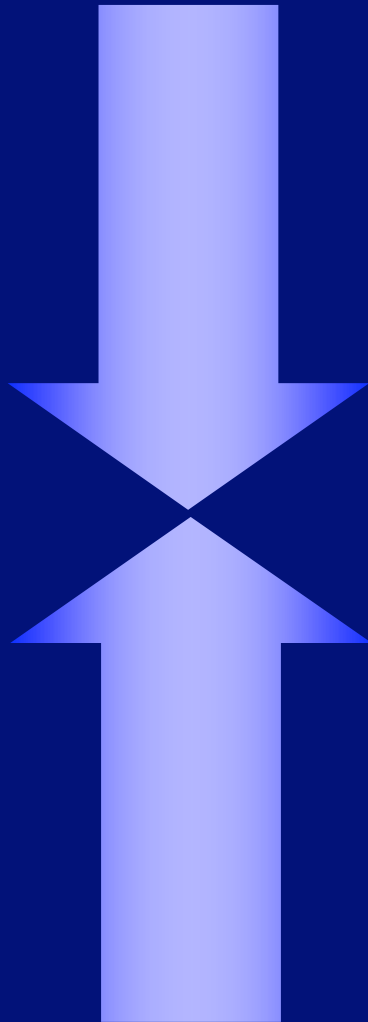
Adapted from Bahill & Gissing (1998)

Systems Engineering Approach

A systems engineering approach leads to scalable, systemic, and sustainable solutions and processes that contribute to the success of the mission, goals and objectives of each National Application.



Application Project Selection Criteria



Socioeconomic Value

Application (User) Feasibility

Mandated Program

Partnership Opportunity

Appropriate for NASA

Science & Technology Readiness

Program Balance

Cost / Budget Context



Application Selection Criteria: Public Health

Appropriate for NASA?

- ✓ **Do vectors, reservoirs, hosts, or disease agents exhibit spatial, spectral or temporal patterns?**
- ✓ **Are vectors, reservoirs, hosts, and disease agents linked to environmental factors?**
- ✓ **Are the patterns and associated environmental factors observable via remote sensing science and technology?**



Infectious Disease & Environmental Health

Disease, Health, & Environmental Parameters

Government, Commercial & Int'l RS Systems

Infectious Disease

Encephalitis

Lyme Disease

Malaria

Rift Valley Fever

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Ocean circulation

Temperature

Vector habitats

Vegetation type and density

Human settlements

Atmospheric constituents

Environmental Health

Asthma / Respiratory

Skin Cancer

Harmful Algal Blooms

Natural & Human Disasters

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*
*

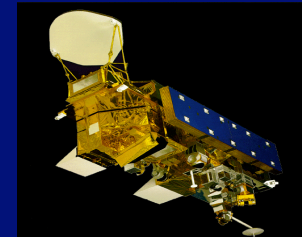
Land surface, soil moisture

Hydrology, Flooding

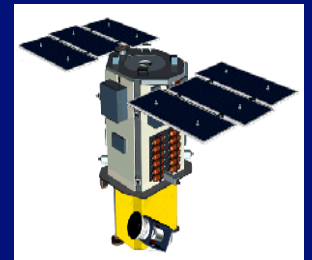
UV Radiation

Contaminant Transport

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Aqua



QuickBird

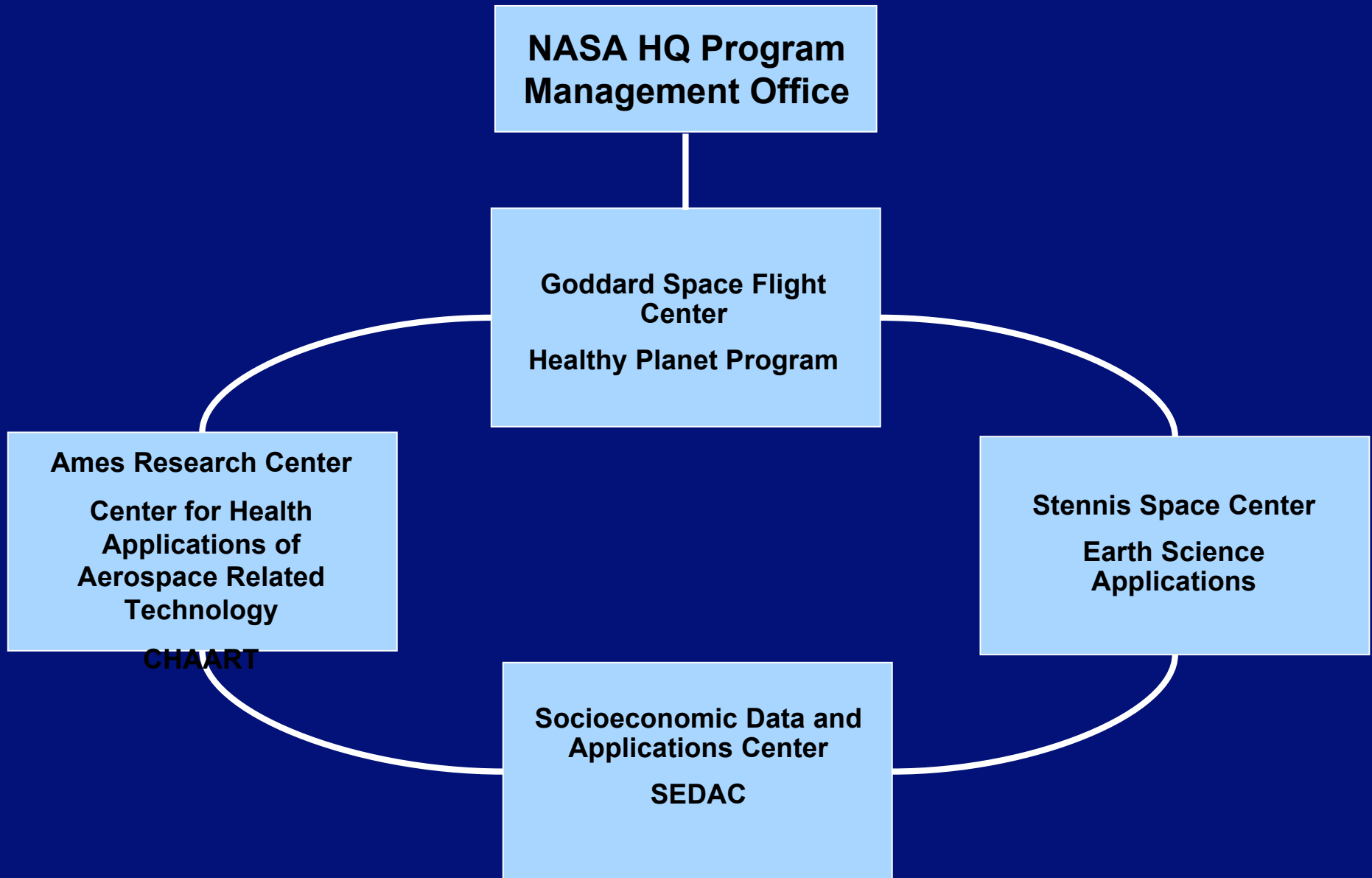


SPOT 5

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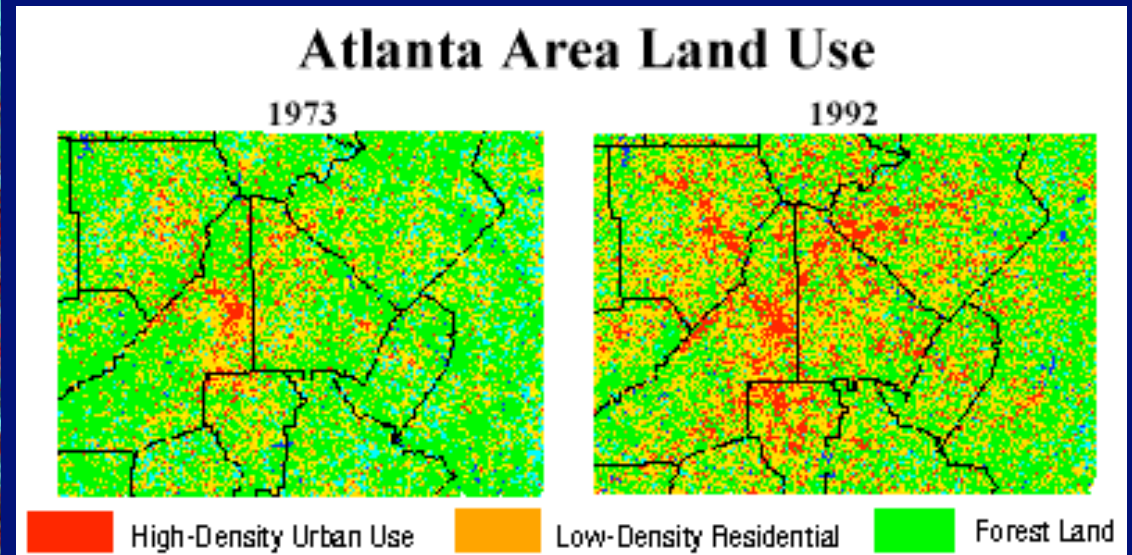
Public Health Applications Program Elements





NASA Heritage Efforts in Public Health

Science Success: Urban Heat Island Effect—use of NASA satellite and airborne instrumentation to model land use impact on heating of cities and ozone generation



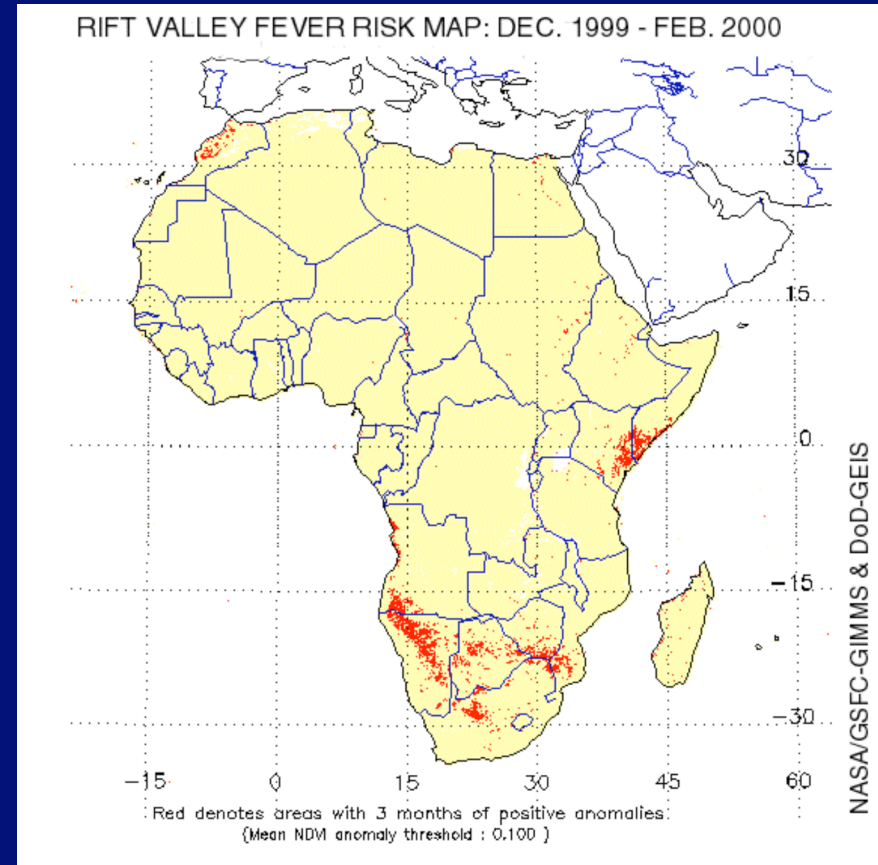
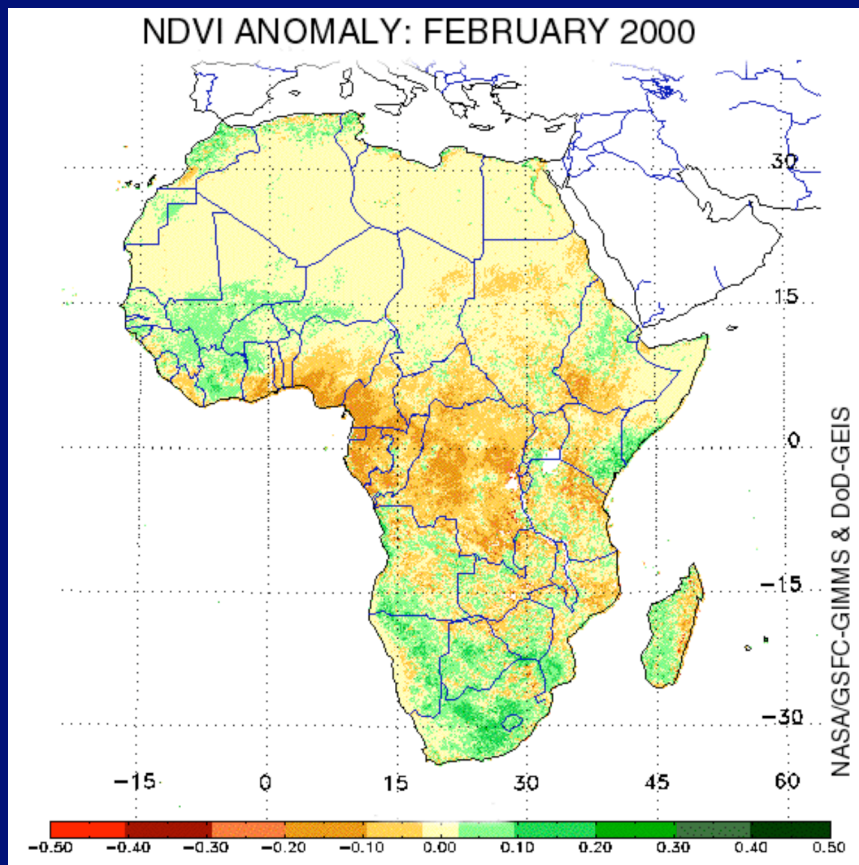
NASA MSFC Global Hydrology and Climate Center, Quattrochi, et al.

Applications Lesson: There is no identified decision-support system or assessment that can use the model outputs



NASA Heritage Efforts in Public Health

Science Success: Rift Valley Fever--predicting regional outbreaks of RVF using satellite data on rainfall, El Nino Southern Oscillation and vegetation

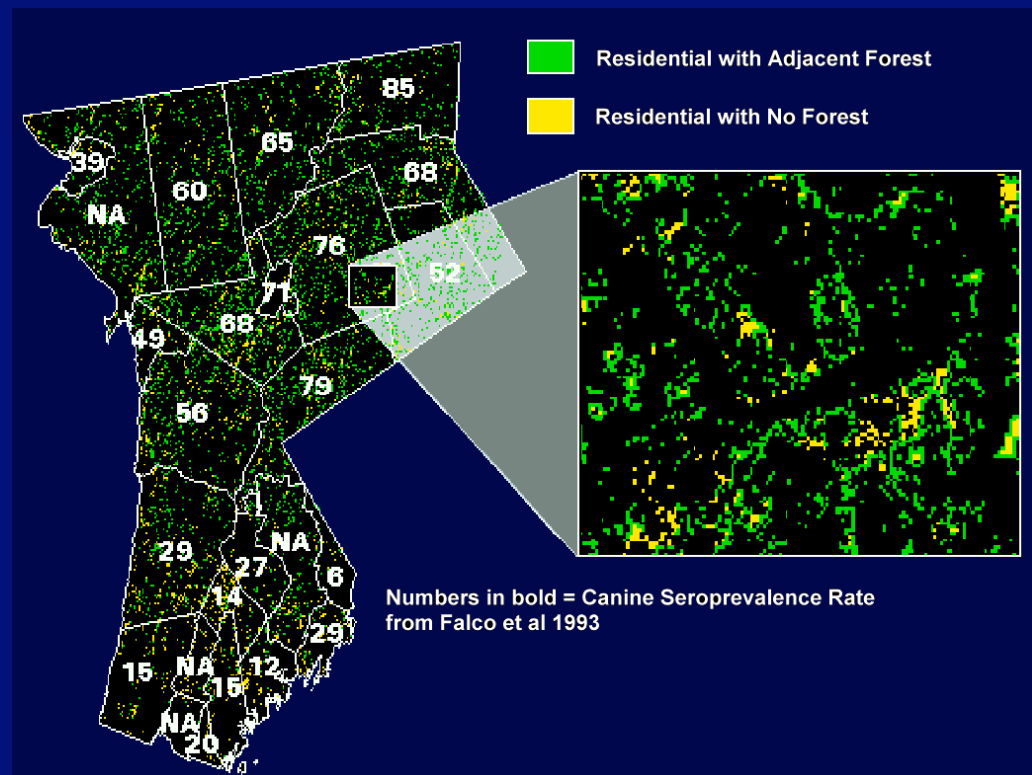
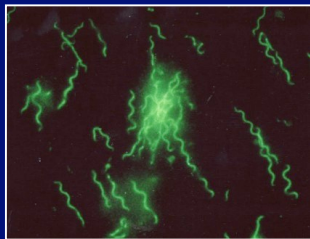


Applications Lesson: No end user defined and the scale is not useful for a public health response



NASA Heritage Efforts in Public Health

Science Success: Lyme Disease--identifying vector-friendly environmental conditions using satellite data on rainfall, vegetation, proximity to human settlements



Applications Lesson: What is the cost/benefit - vaccine better use of resources?



NASA Current Efforts in Public Health

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Thursday, October 17, 2002 f

Gazette Regional News

NASA focuses 'eyes' on West Nile

by Miesha Lowery
Capital News Service

ANNAPOLIS — The National Aeronautics and Space Administration is usually preoccupied with tracking space shuttles and satellites, but soon the lowly mosquito will be on its radar.

The mosquito, a carrier of the West Nile virus, has been spreading the microbe across the country at alarming rates, and NASA is trying to use its innovative technology and satellites to predict where the next outbreak will occur.

NASA's Web site outlines the program and satellite maps that will show land surface temperatures nationwide, vegetation, bird migration patterns and reported cases of birds infected with the virus.

Last year, NASA, Oxford University and New York state began using the virus tracking system to create climate maps based on data from satellites, according to the New York State Department of Health.

These maps revealed areas that are most likely to provide the ideal climate for the virus to flourish, and they tracked areas where the virus already has spread.

"The goal of the program is to extend the benefits of NASA's investments in Earth system science, technology and data toward public-health decision-making and practice," said Robert Venezia, program manager at NASA Headquarters in Washington, D.C., in a written statement.

NASA centers, including the

Goddard Space Flight Center in Greenbelt, will help collect the data.

West Nile travels with infected birds. Mosquitoes feed on the birds and pass the virus to their larvae, humans and animals, continuing the cycle.

The disease can cause flu-like symptoms and can lead to encephalitis, or sometimes-fatal brain swelling.

West Nile's rapid spread this year, NASA said, has been attributed to an abnormally warm winter in 1998 to 1999, which allowed

mosquito larvae to survive and spread almost nationwide. In early 1999, only three states reported cases of West Nile virus, today 35 states have confirmed cases of the virus, with Illinois contributing the highest number of human cases, 654, according to the Centers for Disease Control and Prevention.

The last five winters have flip-flopped between cool and warm with last winter being the second warmest on record in Maryland, according to the National Climate Data Center

Applications Lesson: Continue investment only in partnership with CDC.



Critical Questions

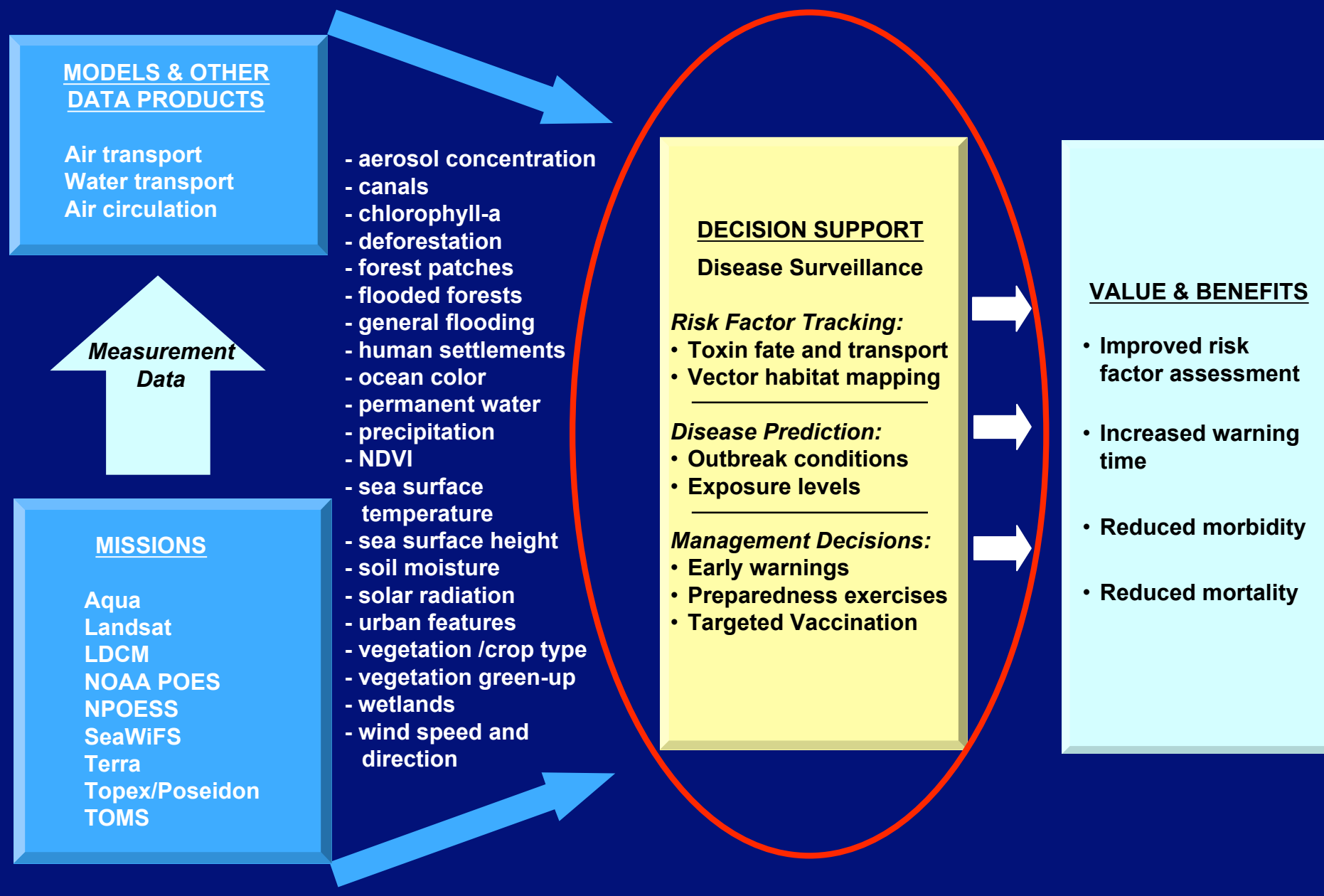
*Remotely sensed data are useful for **research** of environment-disease relationships, however....*

3 critical questions:

- ✓ Can it be used for “....the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action....,i.e. **surveillance?**”
- ✓ Is this application likely to produce a meaningful enhancement to public health surveillance systems?
- ✓ Can NASA demonstrate this through joint efforts and partnership?



Public Health Framework





Stennis FY03 Public Health Applications Team

PUBLIC HEALTH APPLICATIONS FY03 OPERATING PLAN

SSC TEAM FOCUS FOR FY03:

1. Evaluate the potential for ESE mission and model outputs to enhance: EHTN & BDI efforts in ESSENCE and RSVP
2. Host WNV Science Validation Conference

Tertiary:

Identify additional public health decision support systems and/or National Assessments that may benefit from the outputs of ESE missions and models

Provide recommendations for future areas of opportunity based on feedback from the public health practice community

Technical Team:

Dr. Bruce Davis:

RS Science & Requirements

Debbie Fendley:

Public Health

Mary Pagnutti:

Physics, Sensors & Products

Dr. Bob Ryan:

Physics, Sensors & Products

Jim Ryan:

IT Engineering

Dr. Lauren Underwood:

Biology

Timi Vann:

SSC Program Manager

Vicki Zaroni

V&V Engineering

Supporting Interface

ESTO: Dr. Azita Valinia

Modeling: Dr. Tsengdar Lee

CDC NCEH

- EHTN

DoD DTRA - BDI

- ESSENCE
- RSVP



Environmental Health Tracking Network

Purpose: A nationwide tracking system that integrates environmental data with hazard, exposure and disease data. This system will improve disease surveillance and better inform public health officials on the causal factors, prevention and treatment of disease

Federal Partner(s): CDC National Center for Environmental Health, EPA

Mandate: S. 2054 and H.R. 4061 (Conference Pending)

Funding: FY02 \$18 million; FY03 \$28 million

Software platform: interoperable with the National Electronic Disease Surveillance System NEDSS

System configuration: network of networks

Status: Conceptual Design Phase

Website: <http://www.cdc.gov/nceh/tracking>



CDC Awards

Part A Recipients: Planning & capacity building
12 States Plus District of Columbia funded. Total funding ~ 7.1 Million

Part B Recipients: Data Linkage Demonstration Projects

California	791,578	
Illinois	617,956	
Massachusetts	681,586	Centers of Excellence
Missouri	798,513	
New York	762,071	UC, Berkley
Washington	692,823	741,037
Wisconsin	684,548	Johns Hopkins
		699,033
		Tulane
		708,225

Part B Recipient Example Topics:

- Childhood cancer linked to drinking water data, ambient air quality, residential and regional pesticide usage, traffic density and radiation exposure data
- Low birth weight, growth retardation, childhood mortality, and asthma linked to air pollution
- Asthma prevalence, low birth weight linked with traffic exhaust/air monitoring data
- Cancer linked with TCE and PCE levels in ground water



Bio-Defense Initiative: ESSENCE

Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE)

Purpose: A computer-based bio-surveillance system that collects data from medical facilities to detect outbreaks of infectious disease as well as incidences of bio-terrorism. BDI will focus on DSS enhancements (ESSENCE II).

Federal Partner(s): DoD: DTRA/BDI, US Army's Corporate Executive Information Systems & Center for Health Promotion & Preventative Medicine (CHPPM), Defense Advanced Research Projects Agency (DARPA)

Mandate: DoD, DTRA Mandate and Authorization for the Bio-Defense Initiative is pending

Software platform: SAS Graphics, Windows

System configuration: network of networks

Status: ESSENCE I is operational (in use since 1999). ESSENCE II will be proto-typed.



Questions?

